REMARKS

Applicants would like to thank the Examiner for the thorough examination of the present application. Applicants would also like to thank the Examiner for allowing Claims 28-34, and for correctly indicating as allowable the subject matter of dependent Claims 17-21, 37-42 and 45-47.

Independent Claims 16, 35 and 43 have been amended to more clearly define the present invention over the cited prior art references. The claim amendments and arguments supporting the claims are provided in detail below.

I. The Claims Are Patentable

Independent Claims 16 and 35 have been rejected over the Nakagawa et al. article titled "DCT-Based Still Image Compression ICS With Bit-Rate Control." Independent Claim 43 has been rejected over the Ukita et al. patent in view of the Nakagawa et al. article.

The present invention, as recited in amended independent Claim 16 for example, is directed to a method for compressing a digital image comprising a matrix of elements, with each element comprises a plurality of digital components of different types for representing a pixel. The method comprises determining at least one energy measure of the digital image, and estimating a gain factor as a function of the at least one energy measure. The function is determined experimentally according to a target compression factor. The method further comprises splitting the digital image into a plurality of blocks, and calculating for each block a group of discrete cosine transform (DCT) coefficients for the digital components of different types. The DCT coefficients for each

block are quantized using a corresponding quantization table scaled by the gain factor for achieving the target compression factor.

In particular, independent Claim 16 has been amended to recite that determining the at least one energy measure comprises receiving the plurality of digital components, and calculating the at least one energy measure in a pixel domain using the plurality of digital components. Support for "receiving the plurality of digital components" of the image may be found on page 15, lines 23-25 in the specification and as illustrated in FIGS. 1 and 3, in which the energy unit ENRG **190** receives the YUV components of the digital image. Moreover, this feature of the claimed invention is also supported by FIGS. 4a and 4c, in which the block **440** receives from block **435** the YUV digital components of the image to be compressed. Support for "calculating the at least one energy measure using the plurality of digital components" may be found on page 23, line 25 through page 25, line 6 in the specification and as illustrated in FIG. 3.

Independent method Claim 35 has been amended similarly to independent Claim 16. Independent device Claim 43 has been amended similarly to independent method Claim 16.

The Nakagawa et al. article discloses a discrete cosine transform (DCT) circuit and a quantization circuit. The Examiner has taken the position that an energy circuit for determining an energy measure of the digital image, and a processor for estimating the gain factor as a function of the energy measure is disclosed in Sections 4-1 through 4-4 of the Nakagawa et al. article.

More particularly, Nagakawa et al. discloses in FIG. 4 a method for compressing a digital image comprising the steps of: splitting the digital image into a plurality of blocks, transforming all the blocks into DCT coefficients, and calculating an activity metric using all the DCT-transformed blocks for determining an activity (energy) measure for the digital image. Nagakawa et al. further includes calculating a scale factor based on the determined activity measure, and quantizing the DCT-transformed blocks using a corresponding default quantization table scaled by the calculated scale factor. Moreover, with reference to FIG. 6, Nagakawa et al. discloses a proportional relationship, which can be experimentally derived, between the image activity measure and the scale factor.

However, Nagakawa et al. does not disclose a step of determining an energy measure that receives a plurality of digital components representing a pixel. In fact, in Nagakawa et al., the step of determining the activity measure receives blocks of DCT coefficients, and does not include a step for determining an energy measure calculating the energy measure in the pixel domain. In fact, in Nagakawa et al. the step of determining the activity measure calculates the measure in the spatial frequency domain of the DCT coefficients.

To determine an activity (energy) measure in Nagakawa et al., the DCT coefficients of all the image blocks are first scanned. This can be done storing in a memory all the DCT coefficients, then determining the energy measure, calculating the scale factor and then quantizing the DCT coefficients, then determining the energy measure, calculating the scale factor and then quantizing the DCT coefficients

stored with the calculated scale factor. The storage of all the DCT coefficients of the image requires a large size memory.

Alternatively, if the DCT coefficients are not stored, the original image has to be stored. In this case, the DCT coefficients must be re-calculated before the quantization step from the stored original image. As a consequence, this approach requires the DCT coefficients to be calculated two times. The DCT computation is a complex operation that requires a lot of computational resources. In sharp contrast, amended independent Claim 16 recites that determining the at least one energy measure comprises receiving the plurality of digital components, and calculating the at least one energy measure is performed in a pixel domain using the plurality of digital components.

Referring now to Ukita et al., the disclosed compression method comprises a first DCT-pre-compression (FIG. 4) for calculating a quality factor, and a final JPEG compression **56** (FIG. 3). As a consequence, this approach requires the DCT coefficients to be calculated two times. The DCT computation is a complex operation that requires a lot of computational resources. In sharp contrast, amended independent Claim 16 recites that determining the at least one energy measure comprises receiving the plurality of digital components, and calculating the at least one energy measure is performed in a pixel domain using the plurality of digital components.

Therefore, the Applicants submit that amended independent Claim 16 is patentable over the Nakagawa et al. article. Amended independent Claim 35 is similar to amended

independent Claim 16, and it is submitted that Claim 35 is also patentable over the Nakagawa et al. Amended independent Claim 43 is similar to amended independent Claim 16, and it is submitted that Claim 43 is also patentable over the over Ukita et al. in view of Nakagawa et al.

In view of the patentability of the independent claims as discussed above, it is submitted that their dependent claims, which recite yet further distinguishing features, are also patentable over the prior art. Thus, these dependent claims require no further discussion herein.

In re Patent Application of:
BRUNA ET AL.
Serial No. **09/902,439**
Filing Date: **JULY 10, 2001**
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CONCLUSION

In view of the amendments to the claims and the arguments provided herein, it is submitted that all the claims are patentable. Accordingly, a Notice of Allowance is requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

MICHAEL W. TAYLOR
Reg. No. 43,182
Allen, Dyer, Doppelt, Milbrath
& Gilchrist, P.A.
255 S. Orange Avenue, Suite 1401
Post Office Box 3791
Orlando, Florida 32802
407-841-2330

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